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ON THE

MECHANICAL TREATMENT

OF

DISEASE OF THE HIP-JOINT.

BY

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PREFACE.

This little monograph is intended to be just what its name implies—an exposition of the "Mechanical Treatment of Disease of the Hip-Joint"—and nothing more.

Even the minor details of treatment have been purposely left out, in the hope that the general principles involved might impress the mind more deeply and with a clearer force than if buried in a multitude of explanations.

There has been no need to discuss pathology in all its bearings. If, in the opinion of any one, there be cases in which the mechanical treatment, on account of pathological conditions, is not applicable, let such be left out of consideration, But that it does apply with immense advantage to vast numbers, of which a large majority, when taken in time and properly treated, are as curable as cases of simple inflammations in any other location, is the conviction which I desire to impress on the reader's mind.

With these few words, this completer system of mechanical treatment for disease of the hip-joint is respectfully submitted.

CHARLES FAYETTE TAYLOR, M.D.

No. 100 West Fifty-third Street, New-York, June 6, 1873.

DISEASE OF THE HIP-JOINT.

CHAPTER I.

Of two hundred and thirty-six cases of disease of the hip-joint occurring in the "New-York Orthopædic Dispensary and Hospital," the following facts appear:

Disease of right hip occurred in 135 cases, or in 57⅕ per cent.

Of the left hip in 91 cases, or 38⅓ per cent.

Of both hips in 6 cases, or 2⅔ per cent.

Location not recorded in 4, or 1⅔ per cent.

Whole number, 236.

Those cases presenting a clear traumatic cause were 92, or 39 per cent.

Patients whose parents were plainly unhealthy were 44, or 18⅔ per cent.

Parents were healthy, so far as could be ascertained, in 192 cases, or in 81⅓ per cent.

Cases having abscesses at some time during the progress of the disease were 74, or 31⅓ per cent.

The number applying in an early stage of the disease was 86, or 36½ per cent.

Those applying in the later stages of the disease, often with abscesses and great distortion, embraced 150, or 63½ per cent.

The above statements, copied from the records of the Orthopædic Dispensary and Hospital, differ from those obtained in our private practice in the following particulars:

Of sixty private patients, applying in all stages of the disease, 30—or 50 per cent—gave a clear traumatic history. It should be remembered that many of these cases were seen only after several years had elapsed from the beginning of the disease. The difficulty of ascertaining all the facts in regard to incidents occurring several years before, and perhaps not previously connected directly with the disease, in the patient's mind, ought to be considered. Among *recent* cases, about *seventy-five per cent* give a clear traumatic history.

It is also noticed that while many cases have their origin in a single severe fall, blow, or other injury from which the symptoms of the disease promptly spring, the larger number arise from a succession of slighter injuries several or many times repeated.

These injuries are frequently so slight as not to attract attention, and would not be remembered except a repetition of them, followed by symptoms out of proportion with the apparent cause, should call to mind a former accident, accompanied with similar though more slight sensations. It is undoubtedly true that many cases of traumatic origin are the result of accidents so slight as not to make any permanent impression on the individual sensations at the time; and these are followed by others at such wide intervals, as never to suggest any connection as to cause and effect. This is especially true in regard to young children, who get many hard falls and blows when no one sees them, which are soon forgotten by themselves. But in the foregoing statistics, only those cases which were clearly traceable to a traumatic cause have been set down as such. It will be noticed, also, that the proportion of healthy and unhealthy family histories is scarcely greater than the general average in any community.

From the above facts, we may fairly conclude that, at least so far as regards the mechanical treatment, disease of the hip-joint may be regarded as essentially traumatic. This broad statement is strongly confirmed by the fact that the disease, when occurring in a clearly strumous constitution, runs a characteristically more variable and less benign course.

CHAPTER II.

When the hip-joint is invaded by disease—whether by inflammations involving the osseous and cartilaginous structures or merely the synovial membrane—from the simplest "local exaltation of the organic movements," which, under ordinary circumstances, should rapidly tend to resolution, to the more destructive processes liable to be set up in depraved constitutions—there are important reasons why such disease is less likely to run a benign and limited course than when developed in any other articulation. A simple inflammation, excited in the hip-joint by a fall or blow, in a healthy subject, when left to take its course without interference, is very apt to run rapidly into morbid and destructive processes. This fact has led many to regard any disease of the hip-joint to be essentially constitutional and incurable; conclusions not sustained by clinical facts, under improved methods of treatment and more careful investigations into the circumstances attending the earlier history of the disease.

Let us inquire what are the probable causes which determine, under ordinary circumstances, disease of the hip-joint to be exceptionally more serious than disease of a similar character when developed in any other articulation. A little reflection will satisfy us that these causes are mainly mechanical. The hip-joint is the most powerful and important in the body. It is capable of varied motions and able to sustain great weight. The exigencies of its varied motions and great strength require a peculiar anatomical structure. It is a ball-and-socket joint, supported on all sides by powerful muscles, and, under ordinary circumstances, is little liable to injury; but under other circumstances, becomes exceedingly vulnerable. In its ordinary normal action, weight and concussion are not received directly on the joint.

The muscles, by their action, maintain a certain angle in the relation between the trunk and thigh—changing often posteriorly and anteriorly of the vertical line, and by their elasticity prevent any hurtful impinging within the socket. The ball-and-socket articulation furnishes an easy arrangement for escape, in all directions, from direct force upon the joint. Hence, in my experience, the hip-joint is considerably more exempt from those slight strains and temporary injuries which so often occur in other articulations. It is a very rare thing indeed to see any affection of the hip-joint which passes off in a few days without recurring, as is daily witnessed in the ankle, knee, etc. The nature of its function is such that there could be no provision in the construction of this joint for the elastic reception of a direct force upon it. So that when such a force, as a vertical blow, for instance, is received upon the joint without the modifying influence of elastic muscular action, a strong impact is made, which is liable to produce injury.

A lateral force by which the head of the bone is driven directly in upon the socket is even more liable to produce an injury followed by diseased action, than vertical force. The outward slipping of the foot is a frequent cause of this injury to the hip-joint.

But when the hip-joint is once attacked by disease—it is not necessary, in this connection, to inquire whether arising from external traumatic causes or from constitutional development—in what condition is this peculiar articulation to endure it? The head of the bone is confined close in a socket which affords little space for expansion for congested vessels. The intense pain accompanying disease of the hip-joint, like the suffering from inflammation of the nerve of a tooth, is largely due to its impossibility of expansion. And the direct and immediate injury to the inflamed tissues due to their confinement within unyielding structures is correspondingly destructive of local vitality.

But more than this, on the slightest manifestation of irritation within the joint, the muscles are involuntarily thrown into a state of rigidity for the instinctive purpose of protecting the sensitive membranes of the joint from the hurt of motion; and the thigh is drawn into such a position in relation to the pelvis, as will make an angle between them and thereby diminish the effects of concussion. But the muscular rigidity made necessary to diminish the immediate pain and injury of motion, increases the ultimate damage to the joint, not only on account of the steady pressure from the increased muscular action—itself sufficient to destroy the vitality of the parts—but every movement and the weight sustained are transmitted directly to the joint, because of the rigid and inelastic condition of the muscles· So that, on the very first intimation of a diminished ability to bear pressure—which is the great obstacle to a spontaneous arrest of any morbid process within the joint—the exigency of arresting motion to save the joint from immediate pain, causes the muscles to take on a contraction of such a rigid and permanent character as to be a condition of perpetual wounding of the parts. Their own excessive action as well as their inelasticity constitutes a continual source of severest injury. Hence, there is established a self-continuing traumatic condition calculated to increase and prolong any diseased action once commenced in this joint: the more the disease, the more the muscular contraction and rigidity to avoid motion, and the greater the pressure on and injury to the affected tissues. The purely mechanical force of pressure—that which is due to the confinement of the disease within inelastic walls and the vastly increased muscular action which expends its force on already inflamed and sensitive structures—is sufficient to prevent, one would think, any diseased movement, once ever so slightly set up, from terminating by resolution while the pressure continues. But add *motion* to a diseased and compressed joint, and can we wonder at the destructive course disease of the hip-joint ordinarily runs?

We find, then, from our premises as well as from clinical experience, that it is *pressure* or motion *under pressure*, which is the destructive agent in disease of the hip-joint. Hence we derive our two prime indications for mechanical treatment.

1st. To relieve the pressure in the joint due to muscular contraction, by temporarily destroying the muscular irritability and contractility.

2d. To protect the joint from weight and concussion.

The indication for arresting motion in the joint, which is well met by the gypsum bandage and similar expedients, *pertains only to a condition of rigid muscular contraction, and consequent increased constant pressure in the joint. But no such necessity exists after the muscular rigidity has been overcome to the degree of entirely removing all pressure within the joint.*

On the contrary, motion in the joint without pressure is not only not injurious, but it is highly beneficial.

With this brief analysis of the conditions requiring and the indications for mechanical interference, I will proceed to describe the methods by which these ideas may be most fully carried out in practice.

CHAPTER III.

In order to make still more clear the ability of the mechanical treatment presently to be described, to answer every indication previously mentioned as presented in disease of the hip-joint, let us consider, in general, the several plans previously employed for the same purposes, and the causes of their frequent failure.

To Dr. Henry G. Davis we must ascribe the honor of making the first practical application of the idea of counter-extension *with locomotion.* In the year 1855, he began to use his splint for this purpose. He had previously used the "weight, as applied by means of the cord, pulley, and adhesive straps for this purpose, when the patient was confined to the couch." And he was "the first to point out as an always present factor in their destruction, the existence of unremitting pressure, as effected by contraction of the muscles passing over the joints, causing constant forcible opposition of the surfaces within the joint."* Since then, many others have adopted the same plan of treatment, or some modification of it, but the energetic advocacy of similar views by Dr. Lewis A. Sayre, together with his operations upon this joint, have served to bring the subject, in all its bearings, most prominently before the profession.

I should not fail to mention, in this connection, the name of Dr. Gurdon Buck, and his use of extension and counter-extension in fractures for overcoming muscular action.

I will now briefly describe the several methods, and the objections to each.

The weight attached to the leg by means of adhesive straps, cord and pulley, with the patient in the recumbent position, answers a good purpose in competent hands, and is much used. But this method has several important defects. In the first place, it is very frequently adopted, not as the best but as the easiest method; a method supposed to require less thought and attention on the surgeon's part. It is a mistaken idea; but once entertained, too much is expected from little professional attention, and too much is left to the unskilled care of friends and to the chances of time. Because it is esteemed less difficult, it is often used without any definite plan or purpose to be attained, or carefully conducted processes toward their attainment. Hence we find many attempting to treat disease of the hip-joint by this means without sufficient previous preparation or definite ideas of the special objects to be accomplished by counter-extension; and, in too many instances, the patient will be found in bad positions, such as favor the increase of distortion, flexion, and outward rotation of the leg, and very frequent injury to the knee, caused by traction being made wholly below it. The painfulness usual during activity is lessened by the quiet of the patient's position, and this is wrongly credited to the effect of extension; while the muscular contractions are still not overcome, the pressure in the joint continues practically the same, and while the surgeon may fancy that his patient is being cured by extension and counter-extension, he often is really getting only a certain amount of temporary relief from fixation—a result which could be much better obtained by the gypsum bandage. In such a case, the patient realizes none of the special objects for which muscular elongation ought to be used. After a certain degree of amelioration is obtained, and confinement grows wearisome, the sudden transition from the recumbent and confined to the upright and active condition is made. There is no means for graduating the amount of labor put upon the joint, and, after an interval of delusive amelioration, the disease progresses either in an active or more chronic form. But perhaps the greatest objection to the recumbent position with treatment by weight and pulley, is the wearying confinement and the cutting the patient off from the benefits of fresh air, exercise, and nearly all hygienic influences. In a certain few favorable cases, the cure may be so rapid, or the endurance may be so exceptionally great, that no special injury to the general health will be realized. But the majority of cases require so long a time for the complete subsidence of the disease, and the keeping up the general health is so very important a part in these cases, that it is very seldom that a case is confined long enough for the full realization of all the objects of treatment. In careful, experienced hands, the weight and pulley may be made a valuable means: as frequently employed by the careless and inexperienced, my observations in this country and in Europe satisfy me that it is inferior in practical results to the plaster of Paris bandage, which does not seek so much and generally accomplishes the ankylosis which it seeks, and with the leg in a better position than is generally obtained by carelessly employed extension.

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* "Conservative Surgery," pp. 212 and 213.

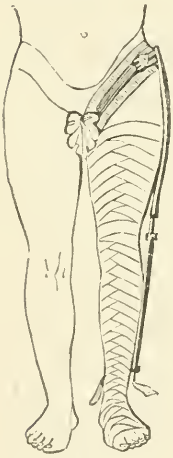
Fig. 1.

The counter-extension splint of Dr. Davis is a bar of steel, (Fig. 1,) and this instrument represents the principle of a large number of similar contrivances —having means of elongation, with the top extending to near the crest of the ilium, from which a padded band passes around the thigh and under the perineum. The lower end of the splint terminates in a buckle just above the malleolus externus, where it receives the end of an adhesive strap which has been applied to the outer aspect of the leg. When the instrument is elongated, the leg is extended by means of the adhesive straps, and counter-extension is made against the perineum and ischium by means of the padded strap first above mentioned. Seeing the deleterious effects of the prolonged confinement necessary in many cases, while he used the weight and pulley with the patient in the recumbent position, Dr. Davis contrived this instrument for the purpose of uniting extension and counter-extension with the ability of locomotion. This instrument can be made very useful in judicious hands; but it has certain defects. The whole weight of the body, in the upright position, rests on the adhesive straps in addition to the extending force of the instrument, which is more than they can bear without slipping and otherwise yielding. And the moment these straps yield, the pressure must increase in the joint. Except with constant supervision, and the greatest care, it is found practically impossible to give adequate protection to the joint, and the result is generally amelioration rather than the complete relief which, with a better instrument, these cases are susceptible of.

It will be noticed that neither of these methods of producing force to overcome muscular action contemplates any thing but direct extension in the line of the leg; there is no means of regulating the direction of the force, or to antagonize any set of muscles which may be more especially implicated in the injurious contractions. In other words, these methods only partially answer the indications for overcoming muscular action and pressure presented in this disease.

There is an instrument widely known as "Sayre's" splint, (Fig. 2,) which is attractive on account of its lightness, and the fact that it reaches only to

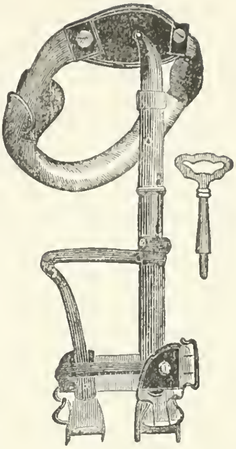

Fig. 2.

the knee, leaving, of course, free motion there, which longer instruments do not permit. It has a branch which passes over to the inside of the knee, where adhesive straps are attached to it from the inside as well as from the outside of the thigh. There is a single perineal strap, and extension is made by elongating the instrument in the usual way, after it is applied as above described. But it is altogether too feeble in its action to be sufficient in the severer cases; and even in mild ones the slipping of the adhesive straps, caused by the movements of the muscles of the thigh in locomotion, makes it difficult to keep up any degree of extension with a uniform force. But motion at the knee is a decided disadvantage. It prevents, or at least diminishes, motion at the hip-joint, which, I have already shown, is useful after complete relaxation of the muscles has been obtained, and the inflammation has partially subsided.

Besides, this instrument has no power of controlling the direction of its force. It can not act directly on the adductor muscles of the thigh, which is a very serious defect. The partial fixing of the thigh, when only the latter is embraced by the apparatus, with the leg left free, makes—with the adduction nearly always present, and which this instrument has no direct action to overcome—a fulcrum and increased strain at the knee, which is extremely liable to be more or less injurious to this articulation. I have often seen great relaxation of the ligaments of the knee, especially the internal lateral ligaments, with genu valgum and partial rotation, after the continued use of this instrument, when there has been an effort to make it efficient.

I believe, however, that it is the practice of those who use the "Sayre's" splint in the milder cases, to resort to the recumbent position with the weight and pulley when the case is at all severe.

CHAPTER. IV.

I HAVE previously shown that the two prime indications for mechanical treatment in disease of the hip-joint are, to overcome the muscular action, and to protect the joint from the effects of weight and concussion.

In regard to the first—I mean not only the *increased* muscular action, which is incidental to the disease with the consequent *increased* pressure in the joint; but *all* muscular action, together with *all* pressure in the joint ought to be removed, as the first step of any treatment which would carry out the true principle of treatment of this disease by extension and counter-extension. A treatment which purports to be this, but which stops short of relieving *all* pressure in the joint by means of overcoming *all* muscular action, is not this treatment at all, but something else far different in principle. And here is where so many think they are adopting the treatment by extension, but, not carrying it far enough to destroy—temporarily at least—the irritability and contractility of the muscles, fail of success. Either through not conceiving that the legitimate object of antagonizing the muscles by counter force, is to *entirely* overcome them, or not having mechanical appliances capable of producing such a result, they must necessarily fail of realizing any of the advantages of this treatment.

It is not enough to stretch the muscles, *they must be stretched till they yield.* And they must be kept stretched and relaxed till the disease in the joint subsides. Only in the latter case will the legitimate result of antagonizing the muscles be obtained.

By what means or device may all the objects contemplated by mechanical treatment in hip-joint disease, as set forth in the preceding pages, be secured? I will proceed to show how it may be done.

The first important object is to seize the leg in such a manner as to exert against it an unyielding force. This should be done in such a manner as will not interfere with the circulation, nor injure the knee, by unequal strain either below or above it. In other words, the whole leg should be grasped in such a manner that the knee will be supported. It may be done as follows: A strip of adhesive plaster, long enough to reach from the waist to the foot, and from three to five inches wide at the upper and about one third that width at the lower end, is taken and cut into five tails as shown in accompanying illustration, (Fig. 3.) A piece from four to six inches long is cut from the centre tail and added to the lower end to strengthen it; and, if the patient be strong, one or two more similar pieces are laid on the same place, where a buckle is attached. Two similar straps are prepared, one for the inside and one for the outside of the leg, and laid against the lateral aspects of the leg, the ends with

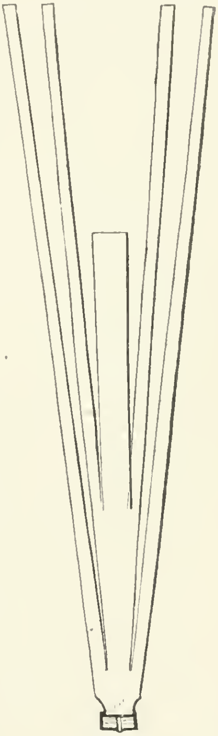
Fig. 3.

the buckles beginning about two inches above the internal and external malleoli, and the centre tails reaching the entire length of the leg and thigh, to the perineum inside and the trochanter on the outside. The lower strips or tails are then wound spirally around the leg to the pelvis and afterward the other two pairs of tails, which are cut down to just above the knee, are also wound about the thigh in the same manner. When completed, the thigh is involved in a network of strips of adhesive plaster, (Fig. 4,) which act equally and without pressure on the whole surface. The leg has about one fourth of the attachments, and the thigh three fourths, which is found to be the right proportion to protect the knee equally from compression or strain. A few turns of the roller bandage are then made around the ankle just under the lower ends of the straps, which serves as a protection to the flesh under the buckles, and then it is con-

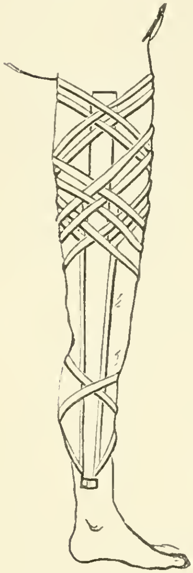

Fig. 4.

tinued over the straps on the whole leg, as shown in the other figures. Thus prepared, the patient is ready for the splint.

This splint is shown applied in Figures 5 and 6, front and rear views, and lettered to correspond. It consists of a hollow rod of steel A, reaching from the ankle to the hip, with the foot-piece C, working in the lower end, and lengthened and shortened by the key H, which works in a rack on the outside of the inside bar. The upper end is solid and very strong, and is used, except in special cases, fastened to the pelvic band B, by a simple bolt at the end, as shown in Figure 13. These figures (except Fig. 13) are shown with a removable attachment between the upper end of the splint as commonly worn, and the pelvic band with a screw at D, by means of which abduction can be made, and the abductor muscles directly antagonized. B is the pelvic band just mentioned, which is made of steel strong enough to support the patient's weight without yielding in the least, and is about two thirds of the circumference of the pelvis, measured over the trochanter

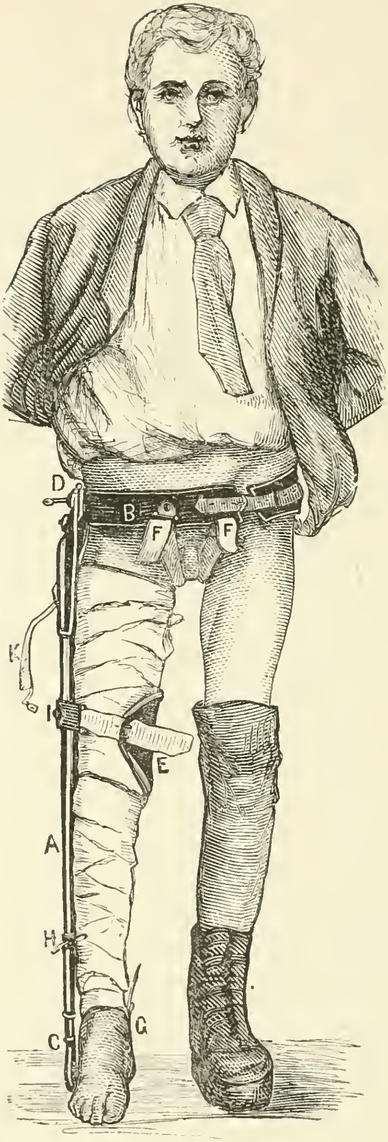

Fig. 5.

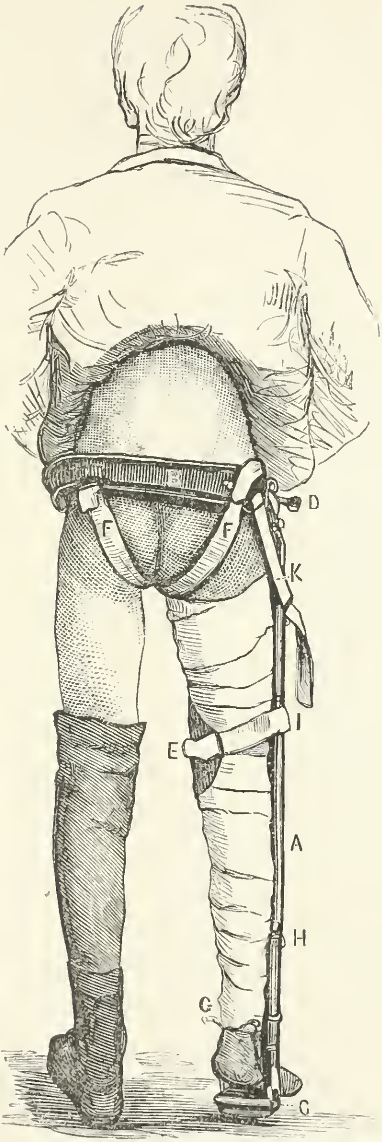

Fig. 6.

major. It terminates in a strap behind, which fastens into a buckle in front. F F are "perineal straps," made of rolls of flannel covered with kid, or some non-irritating material, and terminating in pieces of webbing strong enough to hold in the buckles. These "perineal straps" are near together in front, so as to avoid lateral pressure on the tendons of the adductor muscles, which might be painful, (Fig. 5;) but they spread far apart behind, and pass under the ischii on either side to reach the pelvic band, as will be seen in Fig. 6. E is a leather pad to steady and support the knee, and fastens at I to a movable cross-piece. The foot-piece C—the shaft of which extends up into the hollow bar A—turns under the foot as shown better in Fig. 5, and is covered by a piece of rubber pipe or leather tube, drawn over it to prevent jar in walking on the instrument A leather strap passing under the foot through apertures at each end of the horizontal part of the foot-piece, turns up an end on each side of the ankle, and fastens to the buckles in the ends of the adhesive strips at G, as shown in both figures. The strap K regulates the position of the pelvic band B to correspond to the inclination of the pelvis.

The instrument should always be applied with the patient lying on his back, (Fig. 7,) and great care ought to be taken that the pelvis is not inclined forward by contractions of the flexor muscles. If such should be the case, the leg should be elevated till the lumbar vertebræ come near the couch; or, in other words, the spinal column should be made to take its normal shape by elevating the leg till it can do so. The instrument is then applied as first described. But the pelvic band B ought not to embrace the pelvis tightly, but there should be room enough for the latter to move freely in it. The anterior superior spine of the ilium ought to be above the pelvic band, as shown in Figure 7. When all is adjusted, while the patient still lies on his back, the key H should be turned to the right and the instrument elongated, when the whole leg will be gently but strongly drawn downward and the pelvis lifted up with a direct yet easy force from which there is no escape. In any variation of position or muscular

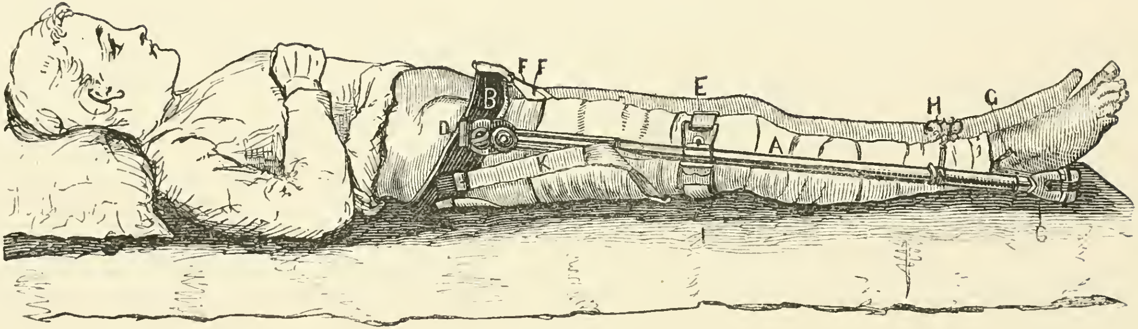

Fig. 7.

action, the direction and amount of force employed are entirely under the surgeon's control. Nor is this all. The instrument should be so adjusted that there is a little space between the foot and the foot-piece, so that in standing or walking the weight does not rest on the leg, but the whole weight of the body should rest directly on the instrument. The patient sits firmly upon the padded straps which, passing under the ischii and perineum, are attached to the pelvic band in front and behind, (Figs. 5 and 6.)

This arrangement for supporting* the patient on the instrument—besides its independent provisions for extension and counter-extension and abduction—increases the length of the affected leg, when it is fully extended, about one inch. The unaffected leg should have the same amount or a little more added to its length, by means of increasing the thickness of the sole of the shoe worn on that foot, as shown in several of the figures. The patient can then progress comfortably and without any danger of either lessening the traction on the muscles, pulling off the adhesive straps, or producing pressure or concussion in the joint. The foot is dressed with the shoe in the ordinary manner, as shown in Figure 13.

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* Dr. Louis Bauer and several others have used splints with the quality of more or less completely supporting the patient's weight,

CHAPTER V.

I DESCRIBED, in the last chapter, the method of applying my extension-splint in the ordinary cases of disease of the hip-joint during the earlier stages, that is, before any great amount of deformity has resulted from the irritation of the disease.

But, unfortunately, large numbers do not see the surgeon till a much later period, and after more or less distortion has already taken place. In such a case, surgeons generally practice tenotomy for overcoming the flexion and adduction of the thigh, and for a number of years that was my practice also. But such a procedure is entirely unnecessary when once we have the means in our hands for antagonizing the actions of *all* the muscles concerned in the production of a distortion. When we have relaxed the rigid muscles, the leg drops at once to its natural position. It is only when there is no power to relax certain muscles that there can be any necessity for dividing them. I except, of course, those cases in the later stage of disease where extensive injury to the joint has been effected with exostoses, adhesions, etc., and there are, consequently, obstacles in the articulation, to the reduction of the deformity. But these latter cases are more rare than might be supposed, and when obstacles other than muscular action exist, it is clear that tenotomy would be equally inefficacious. But all distortions at the hip arising from muscular action—and they embrace so large a proportion of the whole that the exceptions need not be considered here—are speedily removed in the direct and legitimate mechanical treatment of the disease.

Let it be borne in mind that I am speaking of a mechanical treatment of disease of the hip-joint which is capable of actually, not seemingly, overcoming—that is, temporarily destroying—the action of all the muscles concerned in the movements of the thigh, for the purpose of relieving all the pressure—not a part of it—in the joint. The removal of a distortion follows as an inevitable consequence; but it is a secondary though important result; the primary object is to relieve and protect the joint.

Figure 8 is an engraving from a photograph of a boy four years old, after the disease had been progressing for nine months. It represents only an ordinary case of excessive tenderness in the joint, with progressive flexion and adduction of the thigh.

Now, the muscles most deeply involved in the production of this deformity are the powerful adductors of the thigh, and these are the very muscles, because they are strongly contracted, which, according to the principles previously expressed, it is necessary to relax by mechanical means, in order to relieve the injurious pressure they are making in the joint Once relaxed, what becomes of the deformity? And what need of an operation? But to antagonize the adductors of the thigh—the most powerful muscles affecting the hip-joint—is what no other apparatus has been made capable of doing.

Only in an incipient case with abduction and apparent elongation of the leg, do the instruments

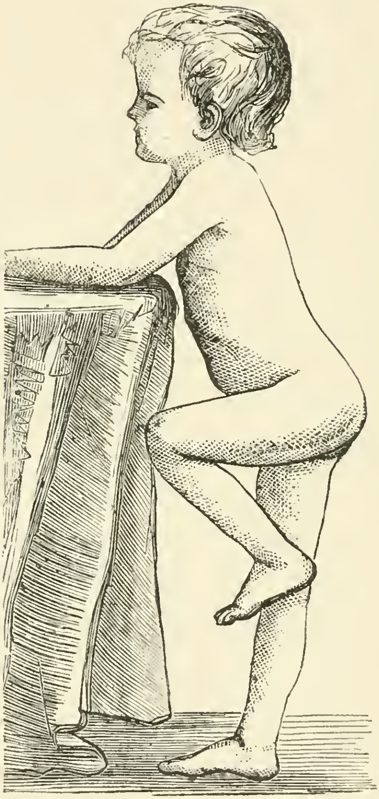

Fig. 8.

heretofore used act directly and principally on the most contracted muscles. But acting only on the outside of the leg, most instruments serve to rather aid in forcing the diseased toward the other leg, which is the tendency most important to counteract.

In cases with only a small degree of distortion, whatever direction it may be, the instrument ought to be applied in the exact position of the leg, abducted or adducted and flexed, as the case may be. Being fixed on both sides of the pelvis, this instrument acts in a direct line with the body, and any muscular action which has carried the leg to one or the other side of that line, must be overcome as a first mechanical effect. Hence slight abductions and apparent elongations, or adductions and flexions, yield readily to the ordinary straight action of the instrument.

In case of slight adduction and flexion, as shown in Fig. 9, for instance, the instrument is applied as shown in the figure, with the leg raised on the inclined plane L. By elongating the instrument, if there is the least adduction, the perineal strap on the

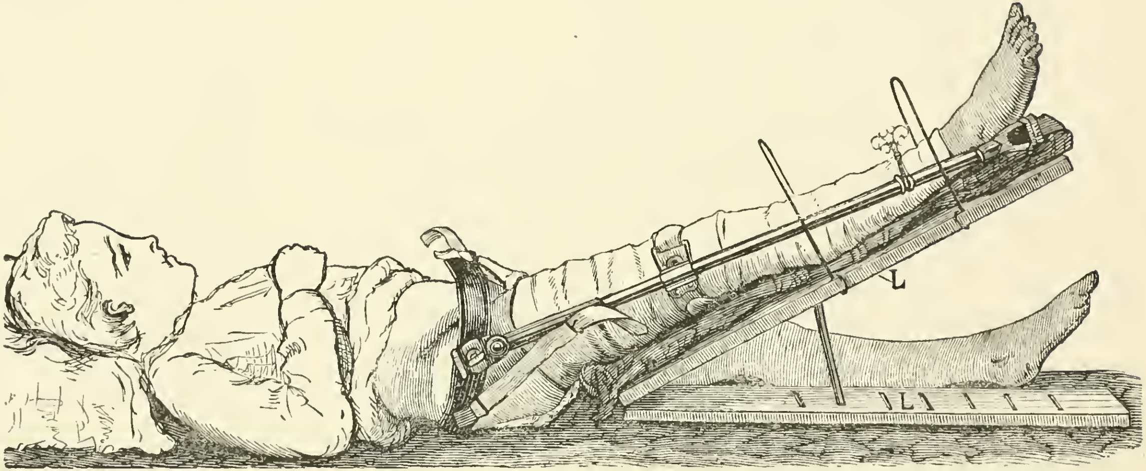

Fig. 9.

opposite will first bring a force against the pelvis on that side, with a leverage directly against the abductor muscles, which overcomes it and brings the leg toward the median line, when the strap next the diseased leg will become engaged. But generally, in case of adduction, either the opposite perineal strap is made shorter, or the abduction screw (D) is used, and the contraction of the adductor muscles more fully overcome by forcing the leg outside the median line. When we have done this, on gradually letting down the inclined plane (L) we find that there is no longer any flexion. A few hours, in the position represented in the figure, (Fig. 9,) gradually changing, are generally sufficient to enable the patient to walk off in the usual manner. But in longer standing cases, the muscles are very much more rigid, when it requires one or two weeks' management to reduce a deformity such as is represented in Figure 8.

Figure 10 represents the position of a patient with long-standing and rigid muscular contraction, with great adduction and flexion at the hip-joint. The instrument is applied without the least attempt to straighten the leg at the hip, and often it is adducted so far as to pass far over the other leg, as shown in the engraving. Great care should be taken to prevent the pelvis from inclining forward, as the flexibility of the lumbar vertebræ will incline it to do if there is rigid contraction of the flexor muscles; but the inclined plane must be carried up till there

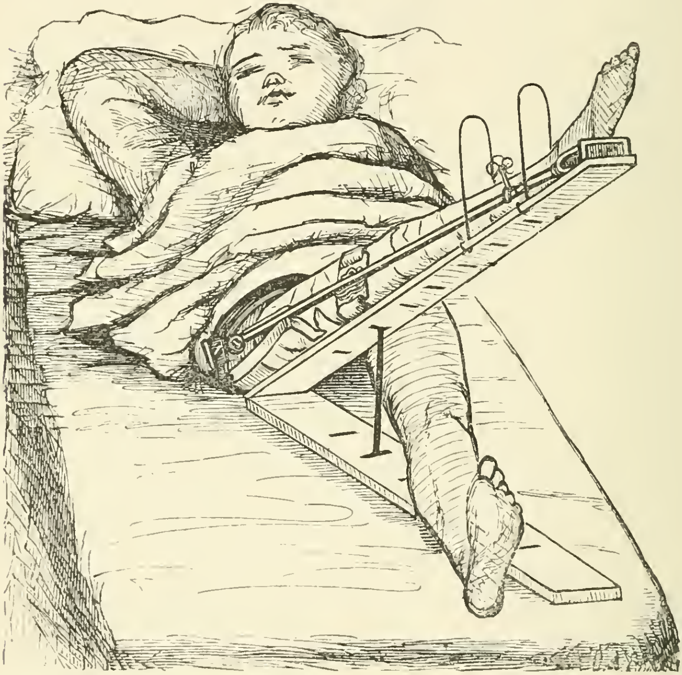

Fig. 10.

is no strain on the flexor muscles, and the back lies close to the couch. (See Fig. 9.) Moderate extension is then made by lengthening the instrument in the ordinary way till the whole leg is well stretched. By turning in the abduction screw (D) the whole power of the instrument is exerted on the adductor muscles. This screw D opens the hinge-joint attachment—represented in all the figures except Figure 13, as elsewhere stated—and forces the shaft of the instrument A and the opposite side of the pelvis farther apart, thus abducting the leg.

This process is carried on from day to day; not forcibly, but only so fast as the muscles relax under the steady, unyielding, extending force exerted on them. In about one week, more or less, according to the age of the patient, and the duration of the disease, the leg will be abducted to the position represented in Figure 11. In the mean time, the inclined plane should not be lowered. After this position has been maintained for several days, the adductor muscles will be found to be completely relaxed, when the inclined plane may be gradually lowered, till, after from ten to fourteen days from the beginning of the treatment, the leg will come down to the position represented in Figure 12. It then represents

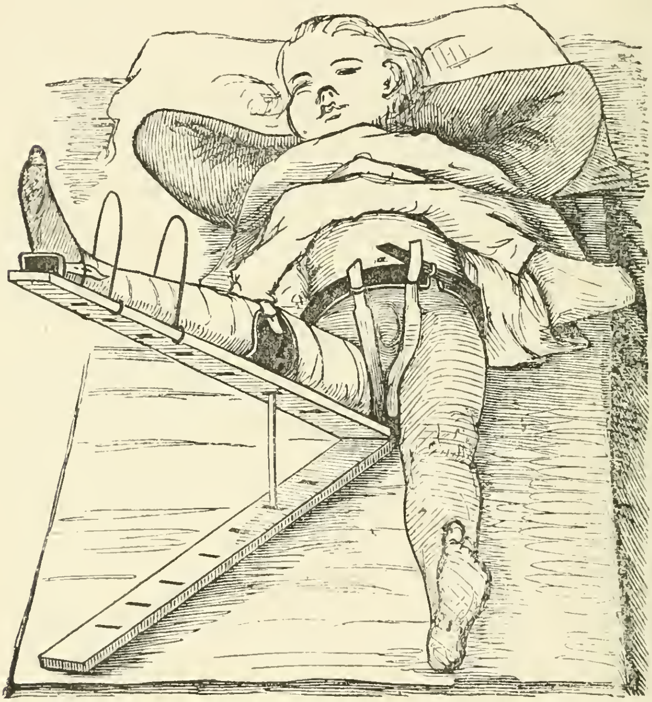

Fig. 11.

the slight abduction incident to the early stage of the disease, and no further attention need be paid to the position of the leg. The extension and counter-

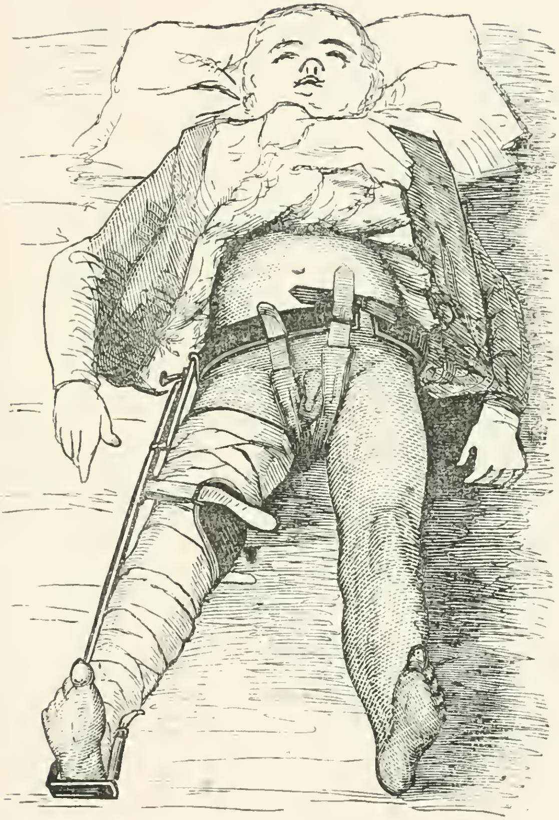

Fig. 12.

extension necessary to be kept up for continued relief to the joint will overcome this abduction and will also effectually prevent any recurrence of distortion. Our course has been reverse to the steps taken in the gradual production of the deformity, from the first slight abduction and apparent elongations of the leg in the first stages of the disease, to the extreme flexion and adduction in the later stage. We have overcome the muscular action by exerting the extending force upon those most contracted, one after another, taking the steps backward to the beginning. During the different steps of the progressive reduction of the deformity above mentioned, we should not forget that our course has been taken because it is the proper course and most effectual for relaxing the muscles for the sake of relieving pressure in the joint. The gradual reduction of the distortion should be regarded as an evidence that we are successful in obtaining this muscular relaxation as a means of treatment rather than the end. During every step and at all times, the prime object of relieving and protecting the joint should never be lost sight of.

Figure 13, which is an engraving from a photograph taken fifteen days after that shown in Figure 8, shows how completely the deformity may be overcome. I do not wish to be understood as objecting to tenotomy when it is needed. I only insist that in nearly all cases of distortion at the hip-joint no operation is necessary, for the simple reason that *all ordinary deformity disappears under the influence of efficient mechanical treatment for the disease.*

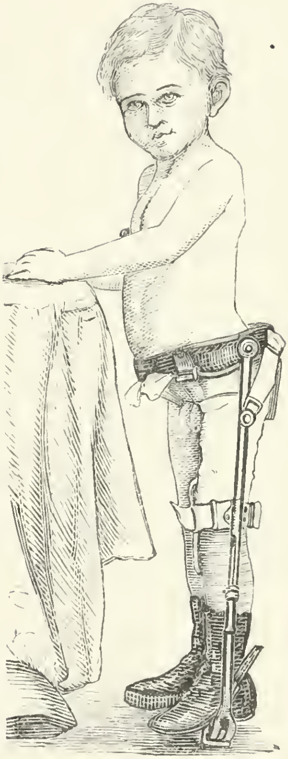

Fig. 13.

The only exception to this rule may be in very long standing cases where extreme flexion has existed till the tensor vaginæ femoris and sartorius muscles have disappeared by degeneration, and we have left only an unyielding cord of tendonous tissue which had better be divided. But this is really no exception to the rule that tenotomy is not generally necessary; for before the contractile tissue has disappeared in those muscles they relax with great readiness. But if it is found after abducting the leg, and the patient has been some days in the position represented in Figure 10, that the leg does not readily come down to the next position, (Fig. 11,) it will be because the fascia covering the thigh has become shortened to correspond to the long-continued flexed position, and there will be an inelastic band continuous to the spine of the ilium. In such a case, I never hesitate to divide this fascia on the anterior and external aspects of the thigh. Division of the tendons of the adductor muscles is never necessary.

CHAPTER VI.

In the mechanical treatment of disease of the hip-joint, nothing should be taken for granted; no favorable termination ought to be expected which is not the result of clearly defined principles faithfully carried out in practice. Above all, there should be no neglect of those constant watchings which are necessary to appreciate the indications as they arise, and the making of those progressive modifications, in obedience thereto, which constitutes *treatment* in the best sense of the word. Patience, painstaking, and perseverance must all be combined, and nothing can be left to chance. The treatment contemplates relief from pressure in the joint *till the end.* A comparatively slight pressure in a sensitive joint may have all the damaging effect that a severe blow would have in a healthy subject; and such an injury may be inflicted any hour during which the proper adjustment of the instrument is neglected. Great pains should be taken to instruct the patient's friends in their duties; and when that is done, as little reliance should be placed on their assistance as possible. Frequent examination of the patient is indispensable.

The length of time necessary for the radical cure of a case varies from six or eight months in mild and recent cases, to several years in more severe ones. I have had a case of perfect restoration of the joint, without the least lameness or restriction of motion, after four years of continuous treatment, during the whole of which time the muscles were kept relaxed, and the patient never once bore her weight on the affected joint. During the last six months, it seemed evident that all diseased action had passed away, but moderate extension was kept up for the purpose of giving the patient the benefit of doubt. She walked away, after removing the splint, with perfect motion and muscular action, and has continued a year as well as any one. This was a young lady of twenty. In children, if seen early, much less time is required. I speak now of cases where the disease has not progressed so far as to preclude a complete restoration. In such cases as have already passed beyond the first or curable stage, the best attainable result is still to be striven for, and the treatment here advocated offers the best means to secure it. But it may require years, in such a case, to accomplish all attainable good. Even in cases where ankylosis of the joint is inevitable, the leg can be kept in the most favorable position for future usefulness. But the unsightly and disabling deformities which we see, as a frequent result of this disease, are entirely unnecessary. They can all be prevented.

But, after all pain and sensitiveness in the joint have ceased, and when there is no longer a disposition of the muscles to take on abnormal contraction, and there is free motion in the joint, is the patient safe? Is he to be discharged as cured? No, not yet. There is a tendency to relapse which must be provided against. If a healthy joint may be injured, surely one which has been recently diseased must be still more susceptible to injury. Such we find to be the fact. Here again we find at the end, as we found in the beginning of disease of the hip-joint, that the great enemy is not motion alone, but pressure. For, the motions of the joint may be kept up for any length of time with only good and no harm, so long as pressure is removed, till the joint is completely well.

To meet this condition of things, I have contrived another instrument which I will now describe.

This apparatus, intended to sustain the weight of the body from resting upon the hip-joint—it answers equally well for the knee—without restricting in any manner the movements of the limb in locomotion, is shown in Figures 4 and 5, and is constructed and used in the following manner:

A strong upright bar of steel (Fig. 14) is jointed at A in such a manner that, when vertical, the rivet of the joint is behind the vertical line. It is evident that with such a joint vertical weight would not only be sustained, but would add firmness to the supporting power. D D are steel plates about one fourth of the circumference of the leg, to which are attached the broad bands of leather which lace around the leg and thigh. The lower steel plate is riveted to the upright, but the upper one is fastened by three "keepers," which enable it to be raised or lowered in adapting the instrument to the length of the leg. B is a foot-piece intended to rest under the foot inside the shoe. The broad band of leather, C, is cut down at the top where there is a firm pad, F, terminating in the strap G, which, when the instrument is applied, fastens in the buckle H. The leather C has the thin metal plate E riveted to it to give it more firmness.

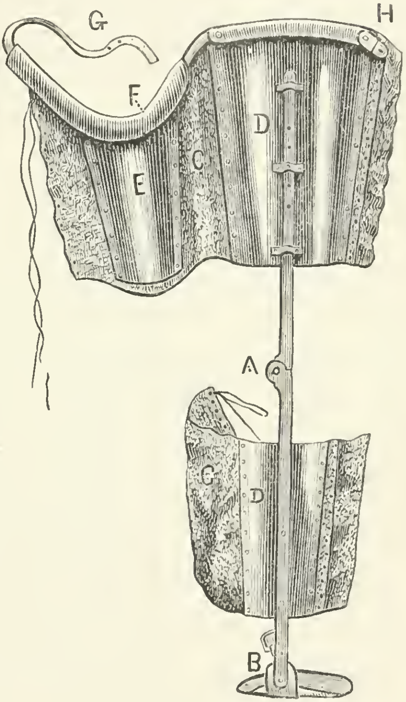

Fig 14.

The instrument is seen applied in Figure 15. It is

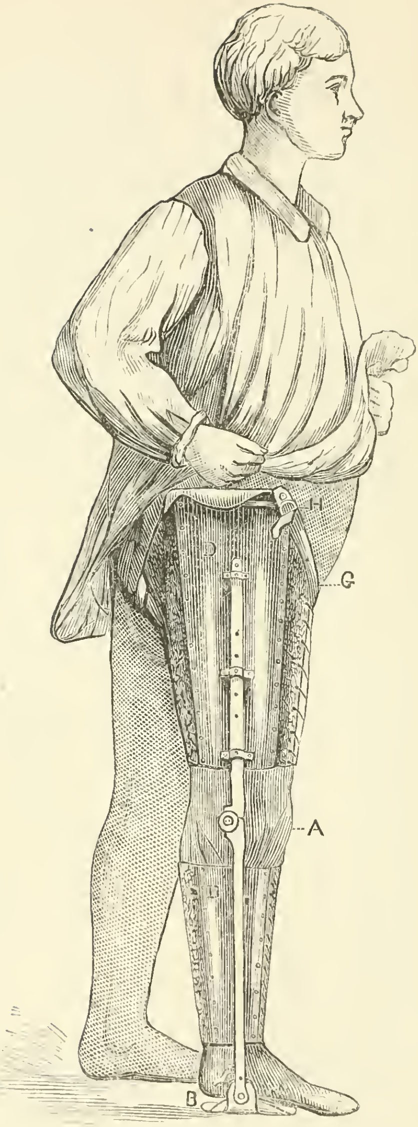

Fig. 15.

adjusted at such a length that the heel does not reach to the foot-piece B, but there is a little space beneath the foot. So that the padded strap G F, as will be seen, passing under the ischium and resting close against the perineum, is arranged in such a manner as to sustain the entire weight of the body while the patient is standing or walking. But care should be used in applying the instrument that it is not laced too close. The leg ought to move freely in it, so that the whole weight will rest on the padded portion at F, and not any on the leg and joint. The foot is dressed in the ordinary manner, the space between the bottom of the foot and the foot-piece being too little to interfere with applying a shoe in the ordinary manner, and the shoe itself is sufficient to keep the instrument in place. But a small piece of adhesive plaster properly applied to the leg, and the lower end fastened to the buckle near the bottom, is generally preferred for sustaining the instrument. It will be seen that by the peculiar construction of the joint at A, the leg, when lifted, bends freely at hip, knee, and ankle, but when straight, as in standing, the joint is forced backward, and the instrument becomes firm and unyielding, and neither pressure nor concussion can be sustained by the joint. A person wearing such an instrument properly applied, walks about with perfect freedom of motion and with no appearance to others that he has a contrivance beneath his clothes which protects the hip, knee, and ankle joints from all pressure or concussion. And while no injury can come to the healthy articulations from the absence of the accustomed weight upon them, so long as their motions are not interfered with, the importance of affording protection to a joint susceptible from previous disease or in the incipient stages of an inflammation, can not be over-estimated.

After exsection of the head of the femur, this instrument may be used by the patient as a permanent support with very great advantage.

CHAPTER VII.

In concluding this exposition of a more complete mechanical treatment for disease of the hip-joint, a few practical observations may not be out of place.

Early diagnosis and prompt, efficient treatment are of great importance; and in estimating early diagnostic symptoms, less regard should be paid to the presence or absence of pain in the knee or hip-joint, than to the condition of the muscles. The disease exists for a certain length of time, as a general rule, before its presence is indicated to the patient's sensations. But the muscular instinct is much more acute than the mental consciousness. There is observed in nearly all cases, a period when there is a slight change in the walk, and other evidences of muscular inelasticity exist, while the patient, if questioned, will deny having pain. If the patient is carefully examined at this time—while motion in all directions may be painless—an experienced examiner will detect a peculiar *quality* to the muscular actions which is characteristic and diagnostic. If the patient be laid on his face and the knee gently but firmly grasped, when strong and extreme movements are made, nothing peculiar may be noticed; while if short and very gentle movements of the joint be made, a *reluctance to relax* may be detected, which is a highly important indication. This peculiar condition of the muscles in incipient disease of the hip-joint is not infrequently mistaken for partial paralysis, an error which a knowledge that pain alone is not diagnostic would be likely to prevent the surgeon from falling into. The absence of pain in knee or hip is no evidence that there is no disease there in any stage. The muscular test is much the most delicate and the earliest indication. Slow and reluctant relaxation of the muscles in short and gentle movements, is diagnostic of incipient disease in the joint. In such a case, treatment ought to follow at once. To wait for painfulness of the joint is to wait for further injury to it. The absence of pain on motion is not evidence of freedom from disease in the joint. This is true in the early stage in many cases. It is especially true that painlessness may exist in certain cases in a later stage with serious disease. In these cases, there is such rigid muscular contraction as to completely arrest all motion in the joint, when there is generally a period of complete exemption from pain. Such a state of things I have known to be mistaken for cure by ankylosis, when it is only a step in the progress of a most serious case. The strong and continuous pressure in the joint occasioned by such contractions, is sure to cause extensive death of bone, and the conclusion of such cases, when the muscular contractions are not overcome by appropriate mechanical treatment to relax them, is apt to be disastrous.

Moreover, ankylosis of the hip-joint is more rare than is generally supposed, and does not often take place till very late. Muscular rigidity should never be mistaken for adhesion in the joint. In regard to abscesses, in incipient cases promptly and carefully treated by this method, they are unknown. In later cases, the presence of a recent abscess, if promptly evacuated, does not necessarily prevent a complete restoration of the joint. No abscess should be allowed to remain unopened a single day after its existence is discovered. The fact of an abscess in or about the hip-joint, is of less importance than the neglect of it. If there is doubt, the "aspirator" is very valuable in determining the existence of an abscess or the reverse. I have taken pus from near the joint in quantities not larger than a drachm, the existence of which could only be inferred. If an abscess is evacuated before it has exerted injurious pressure from accumulation, it seldom discharges more than a few weeks. The retaining an abscess is apt to cause necrosis of the bone with which it lies in contact, and the new disease thus set up is often much more serious than the original one in the joint.

In regard to exercise, neither close confinement nor perfect freedom should be allowed; but a conservative, middle course should be insisted on, care being always taken to protect the patient from bodily fatigue as well as the joint from injury.

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